

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference XA 2020	FOR FURTHER ACTION		See Form PCT/IPEA416
International application No. PCT/GB2004/004901	International filing date (day/month/year) 19.11.2004	Priority date (day/month/year) 21.11.2003	
International Patent Classification (IPC) or national classification and IPC H04B17/00, H04Q7/34			
Applicant BAE SYSTEMS PLC et al.			

- This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 5 sheets, including this cover sheet.
- This report is also accompanied by ANNEXES, comprising:
 - ☒ sent to the applicant and to the International Bureau a total of 5 sheets, as follows:
 - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

- This report contains Indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand 16.08.2005	Date of completion of this report 16.11.2005
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Lustrini, D Telephone No. +31 70 340-1010



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/GB2004/004901

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

3-8 as originally filed
1, 2, 2a received on 16.08.2005 with letter of 11.08.2005

Claims, Numbers

1-10 received on 16.08.2005 with letter of 11.08.2005

Drawings, Sheets

1/2, 2/2 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☒ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☒ the claims, Nos. 11
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-10
	No: Claims	
Inventive step (IS)	Yes: Claims	1-10
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-10
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

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Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1. Reference is made to the following document:
D1: US 6 369 758 (HANG DEEMING) 9 April 2002 (2002-04-09).
2. The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and shows:
a method of determining the amount of signal power and interference power in a received signal, the received signal having a wanted signal and a plurality of interfering signals, the method comprising the steps of:
 - a) selecting a plurality of first known structures in the wanted signal;
 - b) processing the received signal in accordance with said plurality of first known structures to derive a set of amplitude values corresponding to the said first known structures; and
 - c) using the set of amplitude values to determine the power level for at least a portion of the received signal.

The subject-matter of claim 1 differs from this known D1 in that step a) further includes the identification of said plurality of first known structures using a further known structure within the wanted signal.

The subject-matter of claim 1 is therefore new (Article 33(2) PCT).
- 2.1. The problem to be solved by the present invention may be regarded as: it is difficult to perform power assessment during short periods, moreover the response time of the receiver compromises the assessment (page 1 lines 22-28).
- 2.2. The solution proposed by claim 1 is to determine the position of the known structures (FCB's) used for the power/interference assessment, by the exploitation of other known characteristics of the received signal (sync bursts). Once the sync burst is determined, the position of the FCB's is obtained from the published knowledge of the structure of the signal (page 4 lines 16-23).

D1 discloses the use of known structures in the received signal to determine power and interference, nowhere in D1 there is an hint to the solution proposed by claim 2. The

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solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT).

- 2.3. Claims 2-10 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

* * * * *

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SIGNAL INTERFERENCE MEASUREMENT

The present invention relates to signal interference measurement, and is more particularly concerned with measuring the amount of wanted signal power and interfering signal power in a GSM signal.

5 In cellular telephone networks, where there are multiple base stations, it is often necessary to resort to the frequent re-use of frequency channels due to the limited amount of frequency spectrum made available to the operators by the regulatory authorities. Thus, the situation will arise where significant interference from signals transmitted from a plurality of base stations using the
10 same channel is present on a wanted signal at the receiver. Such interfering signals will have the same general characteristics as the wanted signal, but will be unsynchronised in time.

It is a common requirement to be able to measure the level of the wanted signal together with the total level of interference present, for example to
15 perform surveys of system coverage, frequency re-use patterns and to assess degradations in system performance due to such interference.

A particular difficulty associated with the measurement of such interference is that the wanted signal is transmitted continuously or with very short breaks and may be received at a significantly higher power level than the
20 interfering signals. For example, such interference may be around 30dB or more below the level of the wanted signal.

Whilst it may be possible to carry out measurements during guard periods of the wanted transmission, practical experience demonstrates that power assessment is difficult due to the short duration of these guard periods.
25 Moreover, power measurements during the guard periods may be compromised by the response time of the receiver itself, and also by the transmitter transmitting the wanted signal not reducing its power significantly during those periods.

WO-A-99/38270 describes a receiver for receiving a spread spectrum
30 signal which may include unwanted narrow band signals. The technique

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disclosed processes a narrow band signal that is received by decoding and regeneration prior to signal de-spreading.

US-A-2004/0161065 describes a method for reducing interference in a GSM communication system using a Finite Impulse Response (FIR) filter.
5 Complex training software is required and the technique described demands significant processing capabilities.

US-A-6369758 discloses a method of training an adaptive antenna array to cancel unwanted multipath signals and suppress interfering signals. Pseudo random training symbols are used to effect the training signal power and power
10 variance can be determined when certain training symbols are used.

The present invention relates to a technique whereby the interference level may be accurately measured over a wide dynamic range of both wanted and interference power levels in the receiver whilst the wanted signal is being continuously received.

15 According to one aspect of the present invention, there is provided a method of determining the amount of signal power and interference power in a received signal, the received signal having a wanted signal and a plurality of interfering signals, the method comprising the steps of:

a) selecting a plurality of first known structures in the wanted signal;
20 b) processing the received signal in accordance with said plurality of first known structures to derive a set of amplitude values corresponding to the said first known structures; and

c) using the set of amplitude values to determine the power level for at least a portion of the received signal;

25 characterised in that step a) includes identifying said plurality of first known structures using a further known structure within the wanted signal.

Whilst the present invention allows the determination of the power level for at least a portion of the received signal, it is preferred that both the wanted signal power and the interfering signal power are determined.

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Step a) may include identifying locations of a further structure within the wanted signal, and using the identified locations to derive the locations of said plurality of first known structures.

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CLAIMS

1. A method of determining the amount of signal power and interference power in a received signal, the received signal having a wanted signal and a plurality of interfering signals, the method comprising the steps of:

- 5 a) selecting a plurality of first known structures in the wanted signal;
- b) processing the received signal in accordance with said plurality of first known structures to derive a set of amplitude values corresponding to the said first known structures; and
- 10 c) using the set of amplitude values to determine the power level for at least a portion of the received signal.

characterised in that step a) includes identifying said plurality of first known structures using a further known structure within the wanted signal.

- 15 2. A method according to claim 1, wherein and step a) includes identifying locations of a further structure within the wanted signal, and using the identified locations to derive the locations of said plurality of first known structures.
3. A method according to claim 1, wherein said plurality of first known structures comprises Frequency Correction Bursts.
- 20 4. A method according to claim 2, wherein said further known structure comprises sync bursts.
5. A method according to any one of the preceding claims, wherein the step of identifying said plurality of first known structures includes using pointers selected by said further known structure.
- 25 6. A method according to claim 5, wherein said pointers are stored in a look-up table, and step a) includes using said pointers to select said plurality of first known structures in said received signal.

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7. A method according to any one of the preceding claims, wherein step b) comprises correlating the received signal with said selected plurality of first known structures to derive said amplitude values.
- 5 8. A method according to any one of the preceding claims, wherein step c) comprises determining mean and variance values for said amplitude values.
9. A method according to any one of the preceding claims, wherein step c) further comprises using calibration factors to produce an absolute power value for the wanted signal.
- 10 10. A method according to claim 9, wherein step c) further comprises using said calibration factors to produce an absolute power value for the interfering signals.